

HOUSEHOLD GREYWATER SYSTEM WITH ENERGY RECOVERY

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Background

- High quality water is used in toilets and for other processes where water quality is not of high importance. Potable water supplies must be conserved to ensure an adequate drinking water supply for future populations.
- Reusing greywater can effectively reduce demand on water treatment facilities and is an effective measure for reducing potable water demand at the domestic household level.
- The use of domestic reclaimed water for the purpose of flushing toilets has the potential of making a significant impact on reducing water usage, a greywater system is estimated to reduce potable water demand by 15-30%.

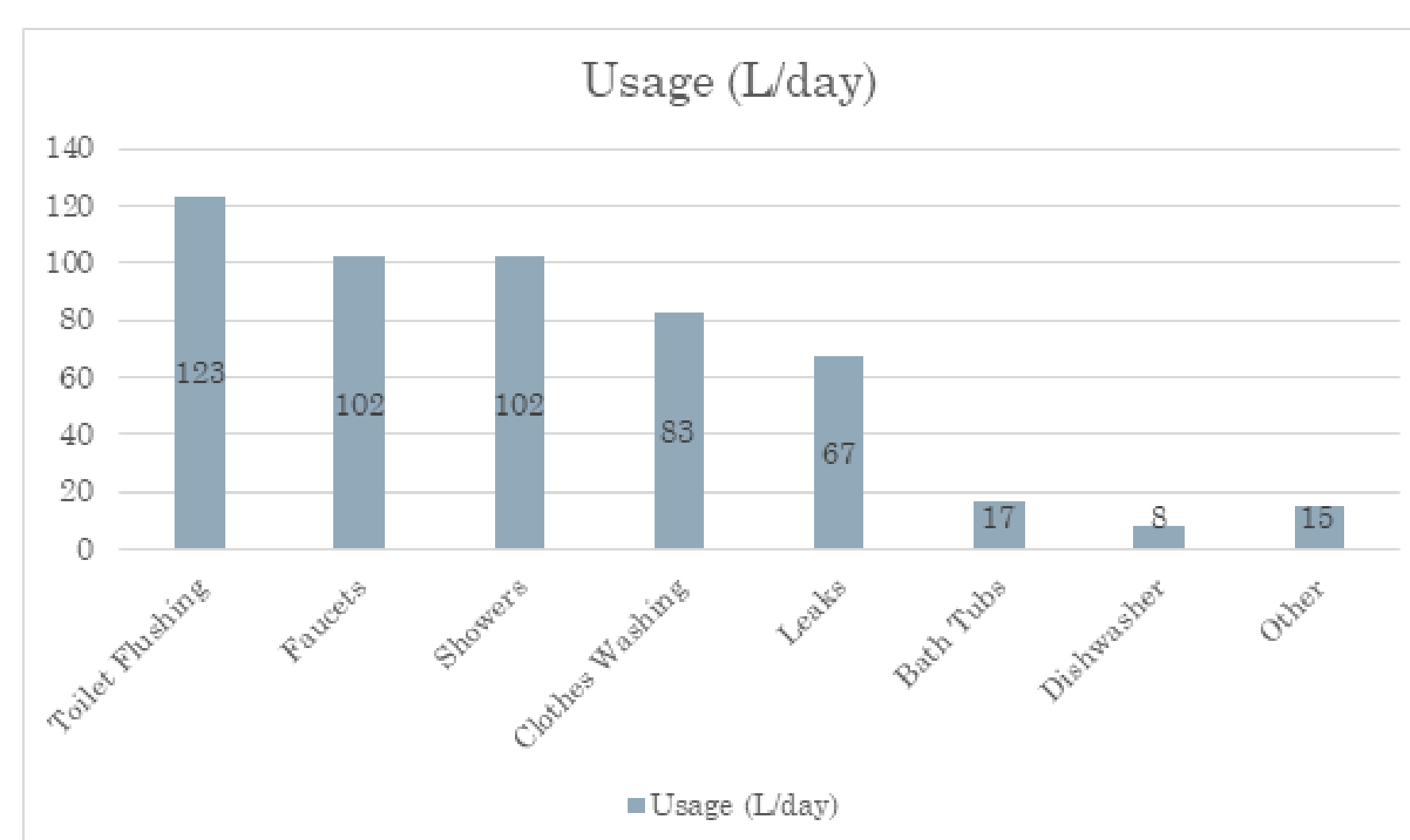


Figure 1. Average single family household water usage

Problem Statement

Over pumping of groundwater aquifers can cause land subsidence and saltwater intrusion, further restricting fresh water supply, therefore there is a need to reduce the demand on fresh water supplies to ensure adequate supply for future populations.

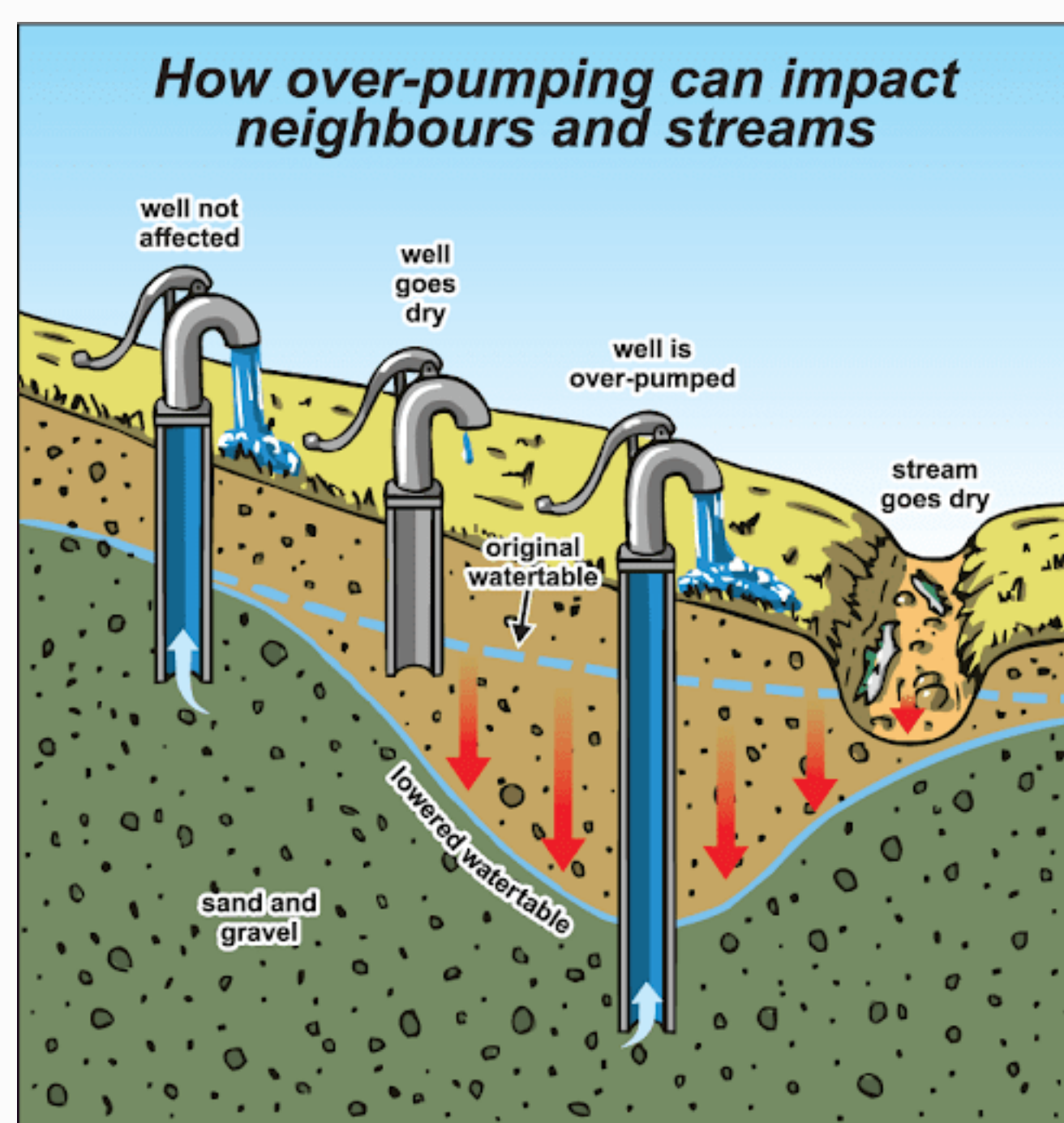


Figure 3. How over-pumping can impact neighbours and streams [1]

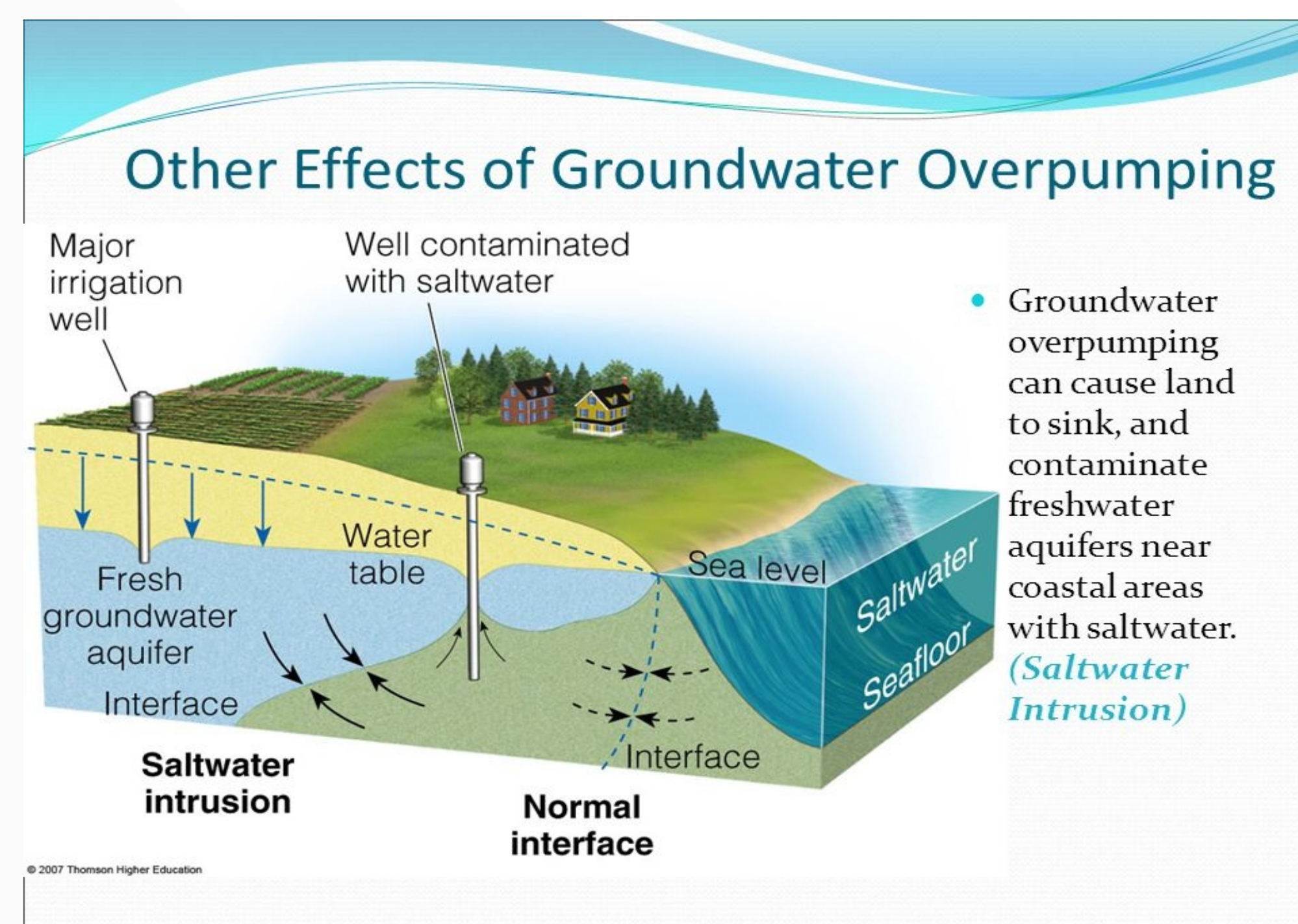


Figure 4. Other effects of groundwater overpumping [2]

Objectives

Specifically, this device aims to:

1. To decrease the amount of fresh potable water used in households
2. Increase the population that can be supplied by an aquifer without depleting
3. Recover energy lost through domestic hot water sent to sewers
4. Reduce the demand on water and wastewater treatment facilities
5. Design a low cost, economical household system for the reuse of domestic water
6. Reduce the water used by residents for watering lawns and flushing toilets

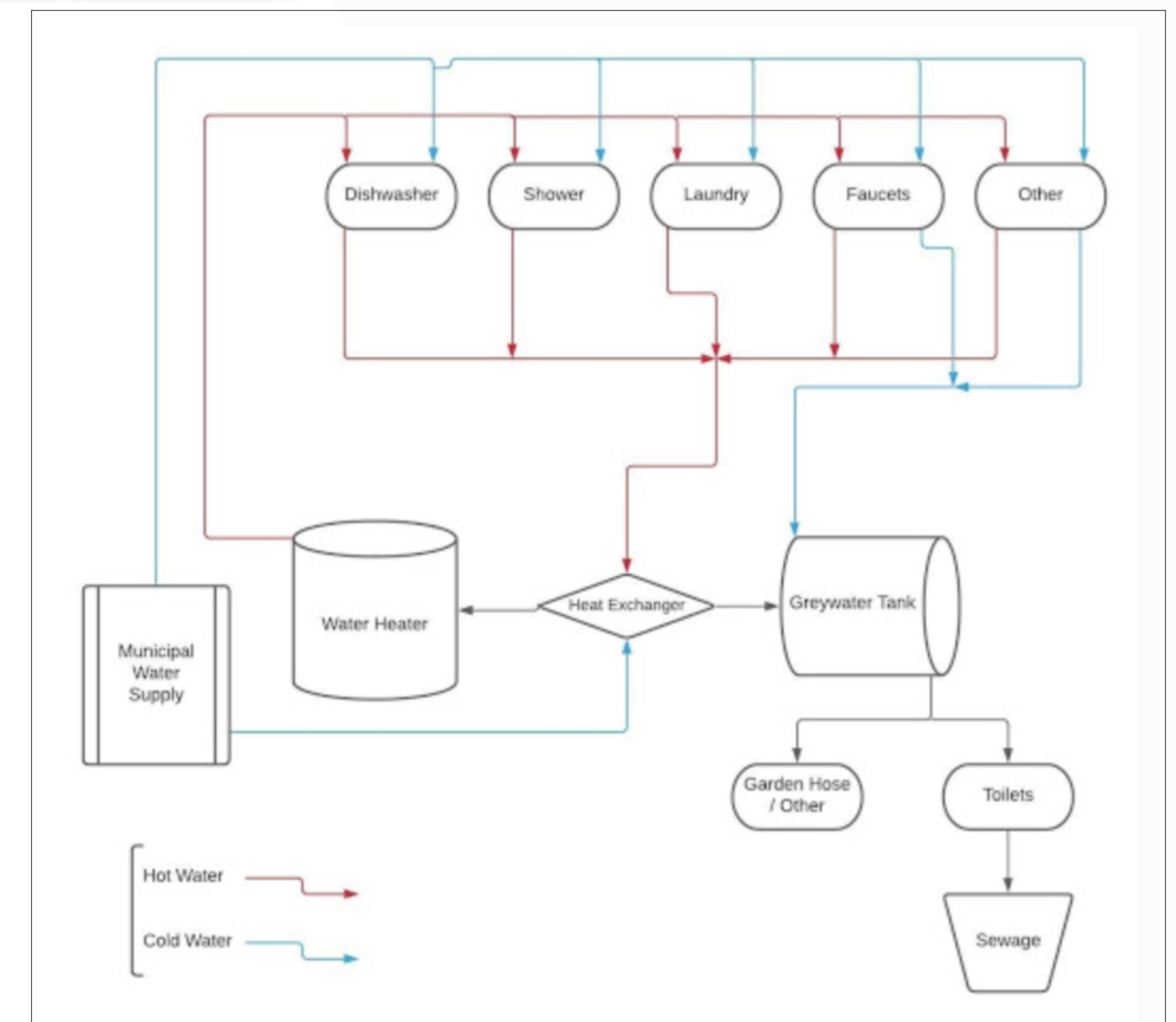


Figure 2. System schematic flow diagram

Design Summary

- The filtration system selected is the coarse-sand filter; it is beneficial for the system to remove possible contaminants. These benefits include reducing clogs in the system and providing cleaner and safer water for garden use or flushing the toilets.
- Sanitation will benefit the system by reducing biological processes from occurring while water is being stored in the tank. It was concluded that chlorination of the tank will yield the greatest result for the system and will ensure the system satisfies the required regulations.
- The heat exchanger is used to fulfill the energy recovery component of the solution.. It was concluded that a double pipe heat exchanger would be a cost effective choice and provide the greatest overall benefit.

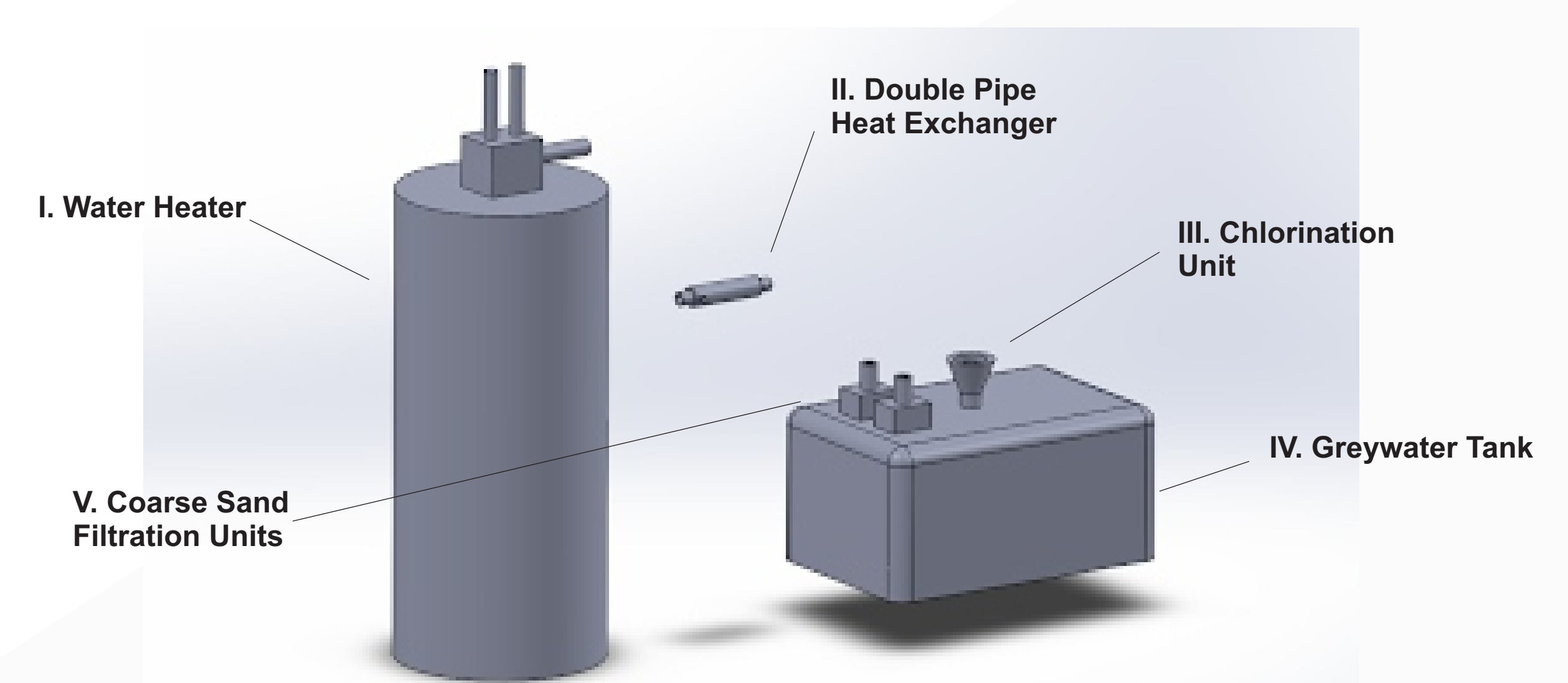


Figure 5. Solidworks model of final greywater system design

Conclusions

In conclusion, a residential greywater system was designed to reduce water and energy demands. Two aspects of the system were analyzed in order to design the most suitable greywater system: water treatment and heat recovery. Further recommendations can be made in regards to additions to the device, such as sensors, automated irrigation, better thermal insulation and other improvements that will increase efficiency and passively help lower energy use.

References:

[1] "What Is an Aquifer?" RDN Water Budget Project, Regional District of Nanaimo, rdnwaterbudget.ca/water-101/aquifers-groundwater/?fbclid=IwAR3sMVJTT4QF54yKOhPlkD3mYUtsa1d5QRCbxSAIM3Ba2r63Fo-wwal.

[2] Mead, Lake, and Ken Dewey. "Chapter 14 WATER RESOURCES. Case Study: Water Conflicts in the Middle East Most of the Water in the Middle East Comes from Three Shared River Basins: - Ppt Download." SlidePlayer, Rosanna Henry, slideplayer.com/slide/10093977/?fbclid=IwAR09ol9qCUpCjWYwCe0MTSdDWIOI-Kav_Zu3qlu1GyIXIkiwzLaSgcEI4g.